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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/927,694	08/10/2001	Charles Thomas Black	BUR919990064US2 (12486A)	7027

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EXAMINER

GUERRERO, MARIA F

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 02/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/927,694

Applicant(s)

BLACK ET AL.

Examiner

Maria Guerrero

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 August 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 31-47 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 31-47 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

1. This Office Action is in response to the Preliminary Amendment filed August 10, 2001.

Claims 1-30 are canceled.

Claims 31-47 are pending.

Information Disclosure Statement

2. The information disclosure statement (IDS) filed on August 10, 2001 has been considered.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 31-47 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 31 recites the limitation "the structure" in line 4. There is insufficient antecedent basis for this limitation in the claim.

Claim 34 recites the limitation "said conductive counterelectrode" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 46 recites the limitation "the annealing step is replaced by the step of allowing said oxygen source layer to decompose during the steps selected from the

group of ferroelectric deposition, top electrode deposition, optional encapsulant deposition, BEOL process and device operation". The claim is vague and indefinite.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 31-42, 45, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jones Jr. et al. (U.S. 5,716,975) (cited by Applicant) in view of Horikawa et al. (U.S. 6,015,989) (as understood by the Examiner).

Jones Jr. et al. teaches method of forming CMOS transistor and ferroelectric capacitor on a single substrate (Abstract). Jones Jr. et al. shows forming at least one CMOS device on a semiconductor wafer and forming a ferroelectric capacitor over the CMOS device (col. 6, lines 13-15). Jones Jr. et al. teaches the ferroelectric capacitor comprising at least a ferroelectric layer, a layer in proximity to a conductive electrode. Jones Jr. et al. shows forming wiring levels (aluminum layer) on the ferroelectric capacitor (col. 7, lines 25-30) (it is inherent that the aluminum layer is formed at temperature below 450°C.). Jones Jr. et al. teaches annealing the ferroelectric capacitor at a temperature between 300 to 425°C for 30 minutes (col. 7, lines 40-49).

Furthermore, Jones Jr. et al. discloses the semiconductor substrate (10) being silicon or gallium arsenide (GaAs) (col. 3, lines 25-30), the ferroelectric layer (60) being

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a strontium bismuth tantalum oxide or a high-epsilon layer (col. 6, lines 23-25, col. 8, lines 44-52). Jones Jr. et al. discloses the conductive electrode and the layer being patterned, the ferroelectric capacitor being planar or non-planar (Fig. 11-14, col. 6, lines 45-60, col. 8, lines 15-25).

Jones Jr. et al. does not specifically show forming the oxygen source layer in proximity to a conductive electrode layer and releasing oxygen from the oxygen source layer into the ferroelectric capacitor. However, Horikawa et al. teaches forming a ferroelectric layer and an oxygen source layer in proximity to a conductive electrode layer (col. 6, lines 40-65, col. 7, lines 10-13). Horikawa et al. discloses releasing oxygen from the oxygen source layer into the ferroelectric capacitor (col. 8, lines 10-50). In addition, Horikawa et al. teaches the oxygen source layer being ruthenium and having oxygen content of 0.001 to 0.1% and being capable of partially decomposing at temperature below 700°C. (Fig. 6, 20, Abstract, col. 8, lines 60-65). Horikawa et al. teaches the ferroelectric layer being BaTiO₃. Horikawa et al. discloses that the process can be equally applied to any semiconductor device utilizing a capacitor in which high dielectric film is employed (col. 6, lines 60-62, col. 8, lines 50-55).

Since Jones Jr. et al. and Horikawa et al. are both from the same field of endeavor of forming capacitors, the purpose disclosed by Horikawa et al. would have been recognized in the pertinent art of Jones Jr. et al.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Jones Jr. et al. reference by including the oxygen source layer as taught Horikawa et al. The modification would prevent any possible

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deformation in shape of the capacitor, would suppress increase of the capacitor leak current, and would simplify the manufacturing step (Horikawa et al., col. 3, lines 30-40).

5. Claims 43-44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jones Jr. et al. (U.S. 5,716,975) and Horikawa et al. (U.S. 6,015,989) as applied to claims 31-42, 45, and 47 above, and further in view of Joshi et al. (U.S. 6,322,849) (as understood by the Examiner).

Regarding claims 43-44, the combination of Jones Jr. et al. and Horikawa et al. does not specifically show the time period from about 1 minute to about 10 minutes, the annealing step being carried out in an inert gas atmosphere. However, Joshi et al. shows the inert gas recovery anneal being conducted from one minute or longer (Abstract, col. 2, lines 64-67, col. 3, lines 5-10, 20-22, col. 12, lines 30-32).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Jones Jr. et al. and Horikawa et al. by including the specific time claimed and the annealing step being carried out in an inert gas atmosphere as taught Joshi et al. The modification would reverse the effects of hydrogen degradation and would restore desired electronic and ferroelectric's properties (Joshi et al., col. 2, lines 64-67).

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Cuchiario et al. (U.S. 6,165,802), Nishioka (U.S. 5,973,911), Tang et al. (U.S. 6,462,931), and Amanuma (U.S. 6,316,801) teach forming ferroelectric


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capacitors. Grill et al. (U.S. 5,932,907) and Adkisson et al. (U.S. 6,333,202) (same Assignee) teach forming FE/CMOS structures. Jung et al. "A Highly Reliable 1T/1C Ferroelectric Memory" and Robert E. Jones, Jr. "Ferroelectric Nonvolatile Memories for Embedded Applications" teach forming ferroelectric memories.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maria Guerrero whose telephone number is 703-305-0162.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-4905. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.


Maria Guerrero
Patent Examiner
January 24, 2003